

## Abstract:

Methods and apparatus for decreasing the time required to calculate a ring-down time from sampled ring-down data and/or increasing the accuracy of the calculated ring-down time are provided. The time required to obtain an accurate calculation of a ring-down time is reduced by performing a linear least squares fit using an estimate B1 of the background, then using the results of the fit to estimate the error in B1. The estimated error in B1 is then used to provide an improved estimate of the ring-down time.

Alternatively, the time required to accurately calculate a ring-down time is reduced by averaging consecutive data points into "bins" and performing a linear least squares fit to the resulting binned signal. The parameters obtained from the fit to the binned signal are then used to obtain an improved estimate B2 of the background, and the ring-down time is calculated by performing a linear least squares fit using B2. Another method, applicable either by itself or in combination with either of the two preceding methods, is to improve accuracy by providing a low pass filter having a bandwidth related to a shortest expected ring-down time, to filter the ring-down signal before it is sampled.